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1883-4.

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THE GEOLOGY OF THE TRACT KNOWN AS "PARADISE," NEAR NEWPORT.

By T. NELSON DALE.*

This spot, so named for its picturesqueness, and well known to every frequenter of Newport, attracted the attention of Dean Berkeley a hundred and fifty years ago. He described it in these words: "We went down to a beach about a half a mile off, where we walked on the smooth sand, with the ocean on one hand, and on the other wild broken rocks, intermixed with shady trees and springs of water, till the sun began to be uneasy. We then withdrew into a hollow glade, between two rocks." In later years these "wild broken rocks" have served as a foreground to artists in their ocean views. Geologists, also, have studied them, and allusions to this spot are to be found in the works of Dr. Jackson, the two Hitchcocks and Professor Shaler.

Situated in Middletown, between the Swamp Road, which runs north from the west end of Sachuest Beach on the west, and the high land, forming the eastern shore on the east, it may be said to extend about a mile back from the beach, thus covering about a square mile. It consists of a series of more or less parallel, rocky, precipitous or rolling ridges and hillocks of varying altitude, the highest measuring from 80′ to 173′ above sea level. There are no less than seven ridges, five high and three low ones, all trending N.NE., but in places coalescing to form a lesser number. These ridges are indicated by Roman numerals on the map (Pl. I) which was drawn from the United States Coast Survey plane table sheet, the contour lines for the higher elevations having been replaced by "hachures."

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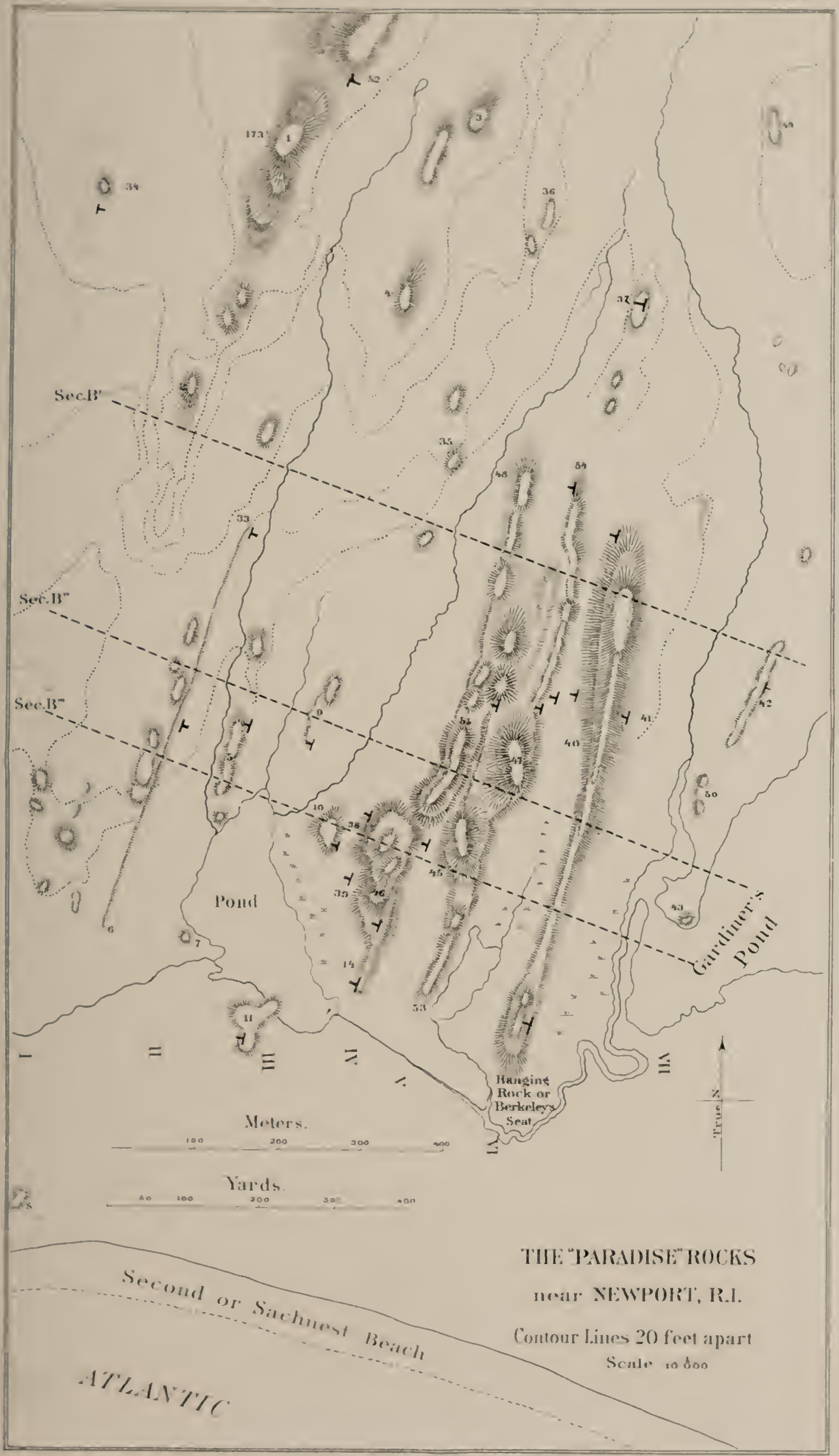
* Abstract of paper read before the Society August 2d, 1883. Published in full in Proceedings Boston Society, Natural History for 1883. Vol. XXII.

The following is a brief summary of the geological features: Ridge I consists entirely of quartzyte conglomerate with a few layers of argillyte striking N. 30 E. (by the compass) and dipping about 45° E. SE. Ridge II consists of the same rocks. The ledge extending from points 6 to 33 is a plane of stratification, dipping 45°—50° E. SE., but on the hillock, point 5, the dip changes to 50°—60° W. NW., and the synclinal thus formed probably extends to the northern portions of the ridge. Ridge III consists of three beds of mica schist alternating with two of hornblende schist; Ridge IV of one bed of hornblende and one of mica schist; Ridge V of two beds of hornblende with an intervening one of mica schist. Ridge III, IV and V thus consist of five beds of mica schist alternating with five of hornblende schist, all with a W. N W. dip of 45°—70°. In places the hornblende schist is very chloritic and contains a little mica and calcite, or is traversed by veins of zoisite. The mica schist in places passes into a siliceous schist and at point 37 becomes a finely laminated, dark grey slate. Ridge VI consists of a 40′ bed of argillyte and of quartzyte conglomerate which, with Ridge VII, forms an anticlinal. The vertical thickness of the conglomerate and its associated argillyte is about 750′, and that of the hornblende and mica schists 950′, giving a total of 1700′. These facts are shown in the sections (Pl. II) which were constructed along the dotted lines on (Pl. I). The vertical scale is of course exaggerated. The beds numbered 1 are quartzyte conglomerate; No. 2 is argillyte; 3, 5, 7, 9, 11 are mica schist; 4, 6, 8, 10 and 12 are hornblende schist. No. 2 reappears east of section B′. A considerable magnetic attraction exists in the vicinity of Ridge VI on the lowland, which may be due either to the minute crystals of magnetite disseminated in the conglomerate or to the adjoining hornblende schist.

CONCLUSIONS.

In the hornblende, chlorite, calcite and zoisite we have evidence of the presence of two substances, lime and magnesia, which are not present in the adjoining conglomerates except in infinitesimal quantities. The repeated alternation of mica and hornblende schists is attributable to the metamorphism of chemically different sediments, the mica containing a larger percentage of potash

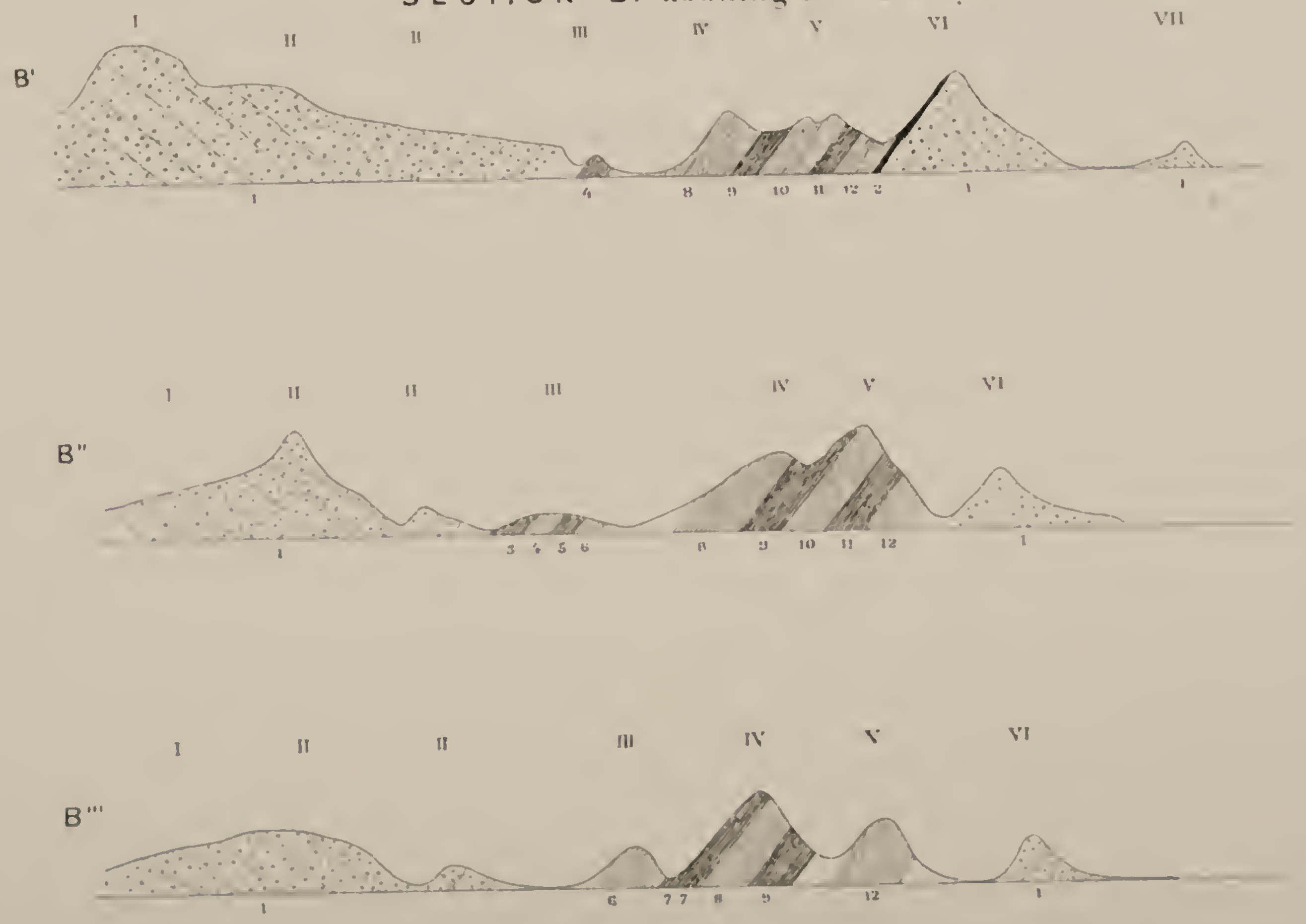


THE "PARADISE" ROCKS
near NEWPORT, R.I.
Contour Lines 20 feet apart
Scale $\frac{1}{10\,800}$

A Meisel Lith.

DALE GEOLOGY OF RHODE ISLAND.

SECTION B. Looking about N. by E.



A. Meisel Lith.

than the hornblende. A similar series of beds was described by Jackson on Neutaconkanut Hill, near Providence, and Prof. J.D. Dana mentions another a dozen miles west of New Haven.[*] It is also not uncommon in metamorphic regions everywhere. It appears probable from Jackson that this series is older than the conglomerate and was forced up in a double fault by the pressure which formed the anticlinal and synclinal on either side, or else these rocks formed an island, around which the conglomerate was deposited and afterwards elevated. The curvature of some of the ridges may be attributed to the N.—S. action of the ice stream upon the upturned edges of strata, striking N. 20 E., true, the glens between the ridges to the erosion of the softer schists, and the relative abruptness of the southern to the northern ends of the ridges to the usual operation of glacial erosion.

EXPLORATIONS IN THE NORTHERN ROCKY MOUNTAINS,

By PROF. RAPHAEL PUMPELLY.[†]

REMARKS ON SOME OF THE EVIDENCES OF GEOLOGICAL DISTURBANCE IN THE VICINITY OF NEWPORT,

By T. NELSON DALE.[‡]

Geologists returning from the far West tell us of vast tracts there, with great thicknesses of strata lying in almost horizontal position, having suffered but little change either in their mineralogical constitution, or in their structure since their deposition by the primeval lakes and seas. Through these vast deposits great rivers and their tributaries have cut meandering channels, forming the celebrated cañons, and affording scenery which surpasses the visions of poets and dreamers. It would be difficult to conceive of anything more different, either geologically or physiographically, from all this than the strata of our vicinity. Not only have the beds been subjected to metamorphic processes which have greatly affected their molecular composition and structure, but they have been so powerfully disturbed that it is very difficult to find a horizontal layer at this end of Narragansett Bay, and after these changes, these wave shaped rock masses were eroded and planed down to their present form by stream and glacier, leaving us at the last but faulted and contorted pediments, one-half of which are under water.

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[*] Manual of Geol. 3d Edition, page 761.

[†] Read before the Society on September 7th, 1883, but unavoidably omitted from the Proceedings for this year.

[‡] Read before the Society on October 4th, 1883.

Perhaps the most striking evidence of stratigraphical disturbance in this region is afforded by the "Paradise" rocks where, as shown in a former paper, some 750′ of quartzyte conglomerate have been folded so as to form a ruptured anticlinal and a corresponding synclinal. Among the less striking but equally important facts of this class may be mentioned the following:

Slickensides. These occur along the "cliffs" between the layers. At Ochre Point the schists dip about 45°, and are crossed by slickenside planes dipping about 80°. At the Portsmouth coal mines graphitic coal and slate occur highly polished by friction.

The unequal flexure which must result from the folding of a mass of strata, necessarily causes friction between the strata. When slickensides cross the stratification, faulting has, of course, occurred.

Minute Plications. These include folds in schist or slate so minute that the distance from the crest of one fold to that of another measures not more than one or one-half inch. Such plicated schists occur at Point of Tree Beach on the west side of Newport Neck, also on Brown's Point in Little Compton, where it affects argillaceous and chloritic rocks, also on the west shore of Mackerel Cove. Such small plications may be due to the same cause as the large folds, but possibly only to the gravity of tilted semiplastic beds.

Larger Plications. An interesting specimen of this lies on the west shore of Mackerel Cove on Conanicut. A piece of finely laminated slate, evidently once a part of the adjoining outcrop, about 6 inches thick and 4′ to 5′ square, has been folded twice so as to form two angles of nearly 90° each. At Beaver Head, on the same island, may be seen some mica schists in a vertical position, folded in and out many times. The jagged ends of these folded strata form the edge of a low cliff. But by far the most interesting exhibition of these rock plications is to be seen on Dutch Island at a little beach midway between the upper and lower wharves. (See Pl. III. fig. I.) On the left side of the figure a fold is seen to have resulted in a fault. A little north of the upper wharf there is an exposure of about ten feet of mica schist strata dipping 60° N.NW., which have been folded over upon themselves so as, right above, to dip 25° S.SW. (See Pl. III, fig. II.) A specimen of schist from Dutch Island, measuring now $5\frac{1}{2}'' \times 10'' \times \frac{3}{4}''$ (when each bend in it is measured.) gives $8\frac{1}{2}'' \times 10'' \times \frac{3}{4}''$ for its original size, showing a diminution in one extension of more than 35 per cent. It has three folds lengthwise, each forming an angle of 60°. In many localities on our island, instead of small folds in the slate, a single or double angle of many degrees occurs, the rest of the rock preserving its general level or inclination. This process of bending or creasing is sometimes extended into a faulting. Of this there are many cases a little north of the Glen on Sakonnet River, where several such miniature faults occur within a space of five feet.

Double System of Folds. In walking from Mr. Lorillard's breakwater around Ochre Point westward the following dips occur in the order given: E.SE., W.NW., E.SE., S.SW., E.SE., S.SW. This occurrence was noted by the Hitchcocks years ago. On the west side of the southern part of Conanicut the dip is NW. or N.NW., but on the east side (the west side of Mackerel Cove) it is mainly NE. or N.NE. On the west half of Newport Neck the chloritic and agillaceous slates about Fort Adams dip E. SE., but the same rocks at Castle Hill and Graves Point dip NE. and even N.NW. Leaving out of these data what may be merely local and accidental, they certainly indicate a pressure operating in an E.SE. to W.NW. direction, and producing a series of folds at right angles to that direction, besides another pressure operating in a transverse direction, that is, in a NE. and SW., or more probably in a N.NE. and S.SW. direction, and producing another series of folds at about right angles to the former. This double system of flexures makes the study of the geology of our vicinity difficult.

Fissures in the Conglomerate. These have often been noticed and described. The best localities are "Purgatory" and the west side of Ridge VI in "Paradise." The fissures are generally nearly vertical and run W.NW. to E.SE. I believe the most satisfactory explanation of these is that after the conglomerate had been corrugated by the E.SE.—W.NW. pressure in folds striking N.NE.—S.SW., the transverse pressure, above referred to, acted upon it; but owing to the rigidity of the deposit and its previous flexure in the opposite direction or possibly to the continuance of the other pressure, the result was only a series of breaks running E.SE.—W.NW. The powerful pressure to which the conglomerate was or had been subjected is shown by the fact that these fissures cleft pebble and cement alike, which would not have been possible had not the rock been compressed into a mass of almost equal density and cohesion. Many of these fissures were then or afterwards filled with veins of milky quartz and it is these veins which furnished the Indians hereabout with so large a supply of white arrow heads.

Dislocated Veins. These are mentioned by President Hitchcock in the protogine, near the Boat House. They occur, also, in chloritic and epidotic schists near Fort Dumpling. The vein matter is a pinkish feldspar and quartz. One vein, but four feet long, is dislocated or faulted ten times, another shows pressure from two directions. The line of contact between these schists and the protogine is at that point much faulted, the two rocks being literally dovetailed into each other, repeating on a larger scale what occurs in the veins.

DALE.

Pl. III.

Fig. 1.

Dutch Island Sections

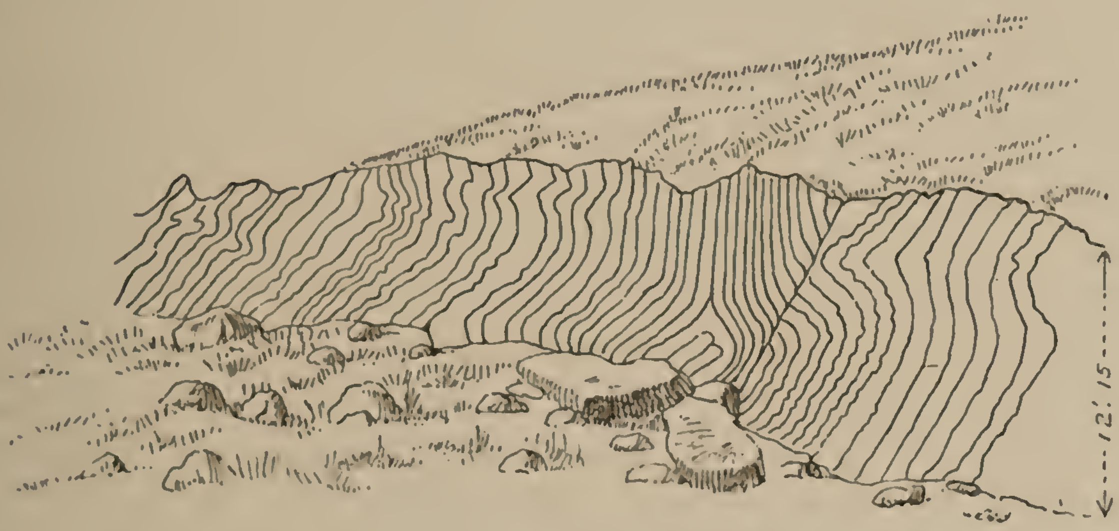
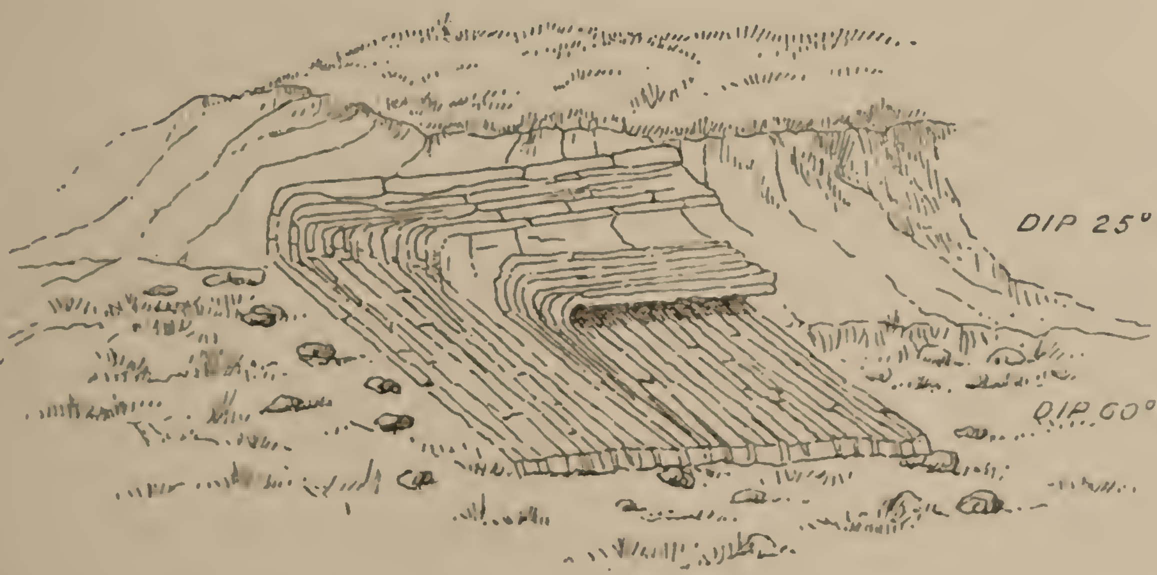


Fig. 2.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STUDIES IN THE RHODE ISLAND COAL MEASURES,

BY REV. EDGAR F. CLARK.*

The persistent and original investigation of any natural science gilds the page of human life. It not only contributes to science but conserves and augments mental strength and enjoyment. While passing with hurried march from church to homestead, our steps have been halted by the Carboniferous rocks of the Rhode Island Coal Measures. The Carboniferous flora of this area possess unique beauty, variety, and significance. The dynamical geology of the Rhode Island coal-belt merits the close attention of all scholars. The forces that acted with more uniform results in Pennsylvania at the close of the Carboniferous Period are here marked by great changes. As the result, this dark mantle of Mother Earth is sadly wrinkled by synclinal and anticlinal, making the study of its dynamics difficult but deeply interesting. The forces that operated to produce the ocean-beds and the ocean-boards are doubtless the chief cause of these disturbances. Before this part of the continent settled into the repose of more modern eras, conflicting forces raged along the New England coast, producing alternate emergence, and submergence, changing coast lines and marshes, until this ancient topography had been subjected to great variations. The southern limit of the Rhode Island coal-belt is hidden beneath the adjacent marine waters.

At Sachuest Neck, near Newport; at Rocky Point; at Bristol and elsewhere, the Rhode Island coal area is lost beneath the bay waters, leaving no well defined southern and eastern limits. Indications point plainly to the belief that the Carboniferous marshes extended across Narragansett Bay from Bristol to Rocky Point, with varying deposits of coal material. The basin of the Blackstone is largely laid in the same coal-belt that crops out at Portsmouth, Cumberland, Warren, Providence and elsewhere in Rhode Island; at Attleborough, Mansfield and Worcester in Massachusetts.

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*Abstract of paper read before the Society, on November 1st, 1883.

The identity of many species of American and European Carboniferous flora demands a careful investigation. Their floral habitats must have been far more intimately connected in the Carboniferous Era, for it is unreasonable to suppose the isolated creation of identical species in such numerous instances upon the two continents. Not only are the botanical orders similar, but many of the genera and the species are identical. Such a homogeneousness argues a community of origin and compels us to bridge the Atlantic for the Carboniferous æon. The uniformity of the early climate and topographical conditions, is insufficient to account for this general similarity, a similarity more and more patent under the generalization of the scholarly Lesquereux.

The oceanic conditions of that era were highly favorable to this terrestrial proximity. The great mountain chains had scarcely a beginning at this era. All of the water that now forms the depths of the ocean then spread in shallows over much of the existing dry land. Great Dismal Swamps, some of almost inconceivable proportions, formed the insular face of the rising continents. As the bottom of the ocean is now made up of mountains, hills, valleys and plains, much as the existing continents, so, before the formation of the ocean-bed by depression, many of the mountains and plateaus that are now covered with marine waters were doubtless Carboniferous territory. These islands of the Carboniferous era were doubtless the highway for the dissemination of the Carboniferous flora from continent to continent, all springing from one primordial habitat. These considerations seem to merit especial attention, and recall the language of Prof. Dana in his Geology, page 317. There, in speaking of fauna, he says: "The Eastern border region is a repetition in many points, though on a smaller scale, of the more Western portion of the continent. The resemblançe of the fossils to the European according to Dawson implies a more direct connection through the Atlantic with the Eastern continent, than existed between Europe and the interior basin."

The meridional trend of the continents, mountains, and oceans is probably due to the forces of the axial revolution of the earth. This same force mapped the form of the Rhode Island coal-belt and the ocean border of New England. It is improbable that all the outcropping strata of the Rhode Island Coal Measures synchronize, yet the question as to their relative age, whether belonging to the earlier or later Carboniferous strata, ought to receive an early decision. Prof. Dana says of the Asterophyllite family, "They are confined to the Upper Coal Measures." If by this is meant the true Carboniferous in distinction from the Subcarboniferous, the remark admits of little discussion. In the true Carboniferous, however, we are constrained by the character of the flora to refer at least the outcropping Coal Measures of Bristol and Newport to the earlier strata. Future research may show that the Asterophyllite family, however, appeared much earlier in some than in other localities, while in some places the conditions favored a much greater longevity of the species.

The employment of various materials in the petrifaction of plants at Bristol and Newport possesses a deep interest. At Bristol, R. I., some of the specimens are laid in pyrites and are singularly beautiful. At Woods Castle, near Newport, many of the specimens are laid in white lime, and resting upon a dark background furnish specimens commanding universal admiration.

The following is a resumé of the Carboniferous flora of the Rhode Island coal area so far as they have come to our knowledge.

Annularia longifolia, *A. brevifolia*, *Asterophyllites grandis*, *A. equisetiformis*, *A. sublævis*, *Alethopteris Pluckneti*, *Bornia radiata*, *Calamites cannæformis*, *C. Cistii* *C. Suckowii*, *Calamostachys prælongus*, *Cordaites serpens*, *C. fimbriata*, *Dictyopteris obliqua*, *Dicranophyllum*, *Hymenophyllites*, *Lepidodendron aculeatum*, *L. dichotomum*, *Lepidostrobus lanceolatus*, *Lepidophyllum tumidum*, *Neuropteris Agassizi*, *N. Clarksoni*, *N. desorii*, *N. tenuifolia*, *N. Loschii*, *N. vermicularis*, *N. plicata*, *N. fimbricata*, *Noeggerathia*, *Odontopteris alpina*, *O. Brardii*, *O. deformata*, *O. Schlotheimii*, *Pecopteris arguta*, *P. arborescens*, *P. Candolliana*, *P. Clarkii*, *P. dentata*, *P. oreopteridis*, *P. affinis*, *P. nervosa*, *P. unita*, *Pseudopecopteris anceps*, *P. dimorpha*, *P. muricata*, *P. Pluckneti*, *P. spinulosa*, *Palæophycus Milleri*, *Rhacophyllum corallinum*, *R. Clarkii*, *Sigillaria reniformis*, *Spirangium multiplicatum*, *Sphenophyllum bifurcatum*, *S. filiculme*, *S. Schlotheimii*, *S. emarginatum*, *Sphenopteris* *cristata*, *S. Grovenhorstii*, *S. pseudo-Murrayana*, *S. elegans and S. intermedia.*

Fruit spikes found at Bristol, have afforded a few nice specimens. One, in our possession, discloses a stem with four seed-lobes arrayed opposite each other and appears to be an exact identification of the *Calamostachys* as drawn by the German Professor Schimper.* Unfortunately it is disconnected from the trunk, although the same specimen furnishes an ordinary Calamite. The uncertainty that has lingered about the *Calamostachys* doubtless receives some light from this valuable specimen. The writer has also the wing of an insect taken at Bristol, R. I., perhaps hitherto unnamed. If found to be a new species, the name *Blatta Americana* might serve for a temporary use.

The study of the Flora of the Rhode Island Coal Measures is worthy of enlisting the interest of all the members of the Newport Natural History Society. The writer, in closing, desires to express his obligations to Prof. Leo Lesquereux, Prof. T. Nelson Dale, Prof. Hitchcock, Charles M. Salisbury, Esq., and numerous friends at Warren, Bristol and Newport, who have aided in his tours among the rocks.

**Zittel u. Schimper, Handbuch der Palæontologie.—Leipzig.*

MOUNT TACOMA FROM THE WEST.

ON SOME CURIOUS FORMS OF FISHES.

By RICHARD BLISS.[*]

MOUNT TACOMA IN WASHINGTON TERRITORY.

By BAILEY WILLIS.[†]

The word "mountain" recalls to the minds of many Eastern people the outline of some part of our Alleghany range, or perhaps of some one elevation with which we have closer links. When a child I lived almost in the shadow of the grand old mountain, Storm King, the western side of the gate of the Hudson River Highlands. Although I have since ridden over much of the mountain region from Alabama to New York, the impression made then has never been effaced; Storm King remains to me still the ideal type of our lovely and loveable mountain scenery. Its broad, round shoulders stoop with the weight of many hundred thousand years; its curving outlines, and the shading of its garb of rustling leaves, lend softness to the landscape, and its aspects harmonize in all seasons with the setting of cultivated fields and human associations. This is true of the hills and valleys of Pennsylvania; it is true of the wilder parts of North Carolina and Tennessee. A farmhouse always seems at home nestling among the sheltering arms of the friendly hills. But in the past two years I have put beside my Storm King another ideal; the great young mountain, upon whose jagged peaks my thoughts centre to-night, Mt. Tacoma, the type of the massive grandeur stamped upon nature in the far West. The two represent extreme age and youth among mountains. Storm King has watched the building of our continent and would mark as an event of yesterday, in its calendar of ages, the birth of the great volcano, the offspring of those Tertiary eruptions whose smouldering craters reach from Alaska to Patagonia.

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[*] Title of paper read before the Society on December 6, 1883.

[†] Read before the Society on January 3d, 1884. The accompanying Artotype of "Mount Tacoma from the west" was taken from a sketch made by the author.

Nowhere in the United States is there a larger area of the eruptive rocks of that period than in Washington and Oregon. In the western part along the Cascade range, many great snow-clad peaks have been formed from the volcanic outbursts; while in the east, thousands of square miles of basaltic plains extending into Idaho, have resulted from the later massive eruptions. Eight of the volcanoes of the western belt are particularly conspicuous:—Mt. Pitt, the Three Sisters, Jefferson and Hood in Oregon, Mt. Adams, St. Helens, Tacoma and Baker, in Washington territory. Of these the highest are Mt. Hood, 11,225 feet, Adams, 12,250 feet, and Tacoma, 14,300 feet. There are a number of peaks in Colorado above 14,000 feet, but, like the great mountains in the Andes and the Himalayas, they are surrounded by others of so nearly the same elevation, that their height is not apparent, as is that of Tacoma which towers 8,000 feet above the highest point within 40 miles. Mt. Shasta in California is an isolated cone, 14,400 feet high, but its position, far from the sea in the great Yreka plain, makes impossible from any point of view that magnificent sweep with which Tacoma rises from Puget Sound.

Looking from the wharf at New Tacoma, the eye reaches across the dancing waters of the bay to the waving surface of the salt marshes about the mouth of the Puyallup; along the river, masses of light green indicate the groups of cottonwoods and maples receding till they are lost in the sombre setting of the evergreen forest; it is a bright, lovely scene in itself; but it is forgotten as the clouds part toward sunset and reveal the gigantic mountain, the single cone of snow. The foreground and the distant peak reflect the glory of the western sky; between them stretches the belt of forest, dark alike beneath the noonday sun and evening glow. This forest is the magic circle drawn by the spirits of the mist about their ice palaces on the mountain. From the warm western winds they gather the gentle showers, under whose vivifying influence the plant world flourishes with almost tropical luxuriance. The fir trees raise their great trunks straight as an arrow, competing for the sunlight, a hundred to a hundred and fifty feet, without a limb; then they branch into thick masses of evergreen needles that shut out all brilliant light. Their tops are usually 225 to 300 feet from the ground, considerably higher, I presume, than any of the Newport steeples. Hemlocks and cedars fill the lower spaces with feathery foliage, while the ground is hidden by the broad, glossy leaves of the salal bush, the graceful fronds of the ferns and a carpet of golden brown moss. The fallen trees stretch their gigantic lengths in all directions; many of them supporting a whole nursery of delicate young hemlocks, others wasted away after centuries to long, low waves in the general surface. The ground pine of our eastern woods and the little Linnæa are interlaced on the mossy knolls and hang in festoons from the decaying stumps. Sometimes the sunlit top of a dead tree, broken off fifty feet from the ground, supports a little colony of tender vines and bushes waving gaily on their lofty perch.

Amid all this exuberant plant growth there is comparatively little animal life. Deer, so numerous in the open forests of the eastern slope, avoid a region so difficult to pass through. The panthers and wolves follow the deer. Black bears are more common, and their well trodden paths may often be found about the wild berry patches; but the dreaded grizzly does not come so far north. The only creatures often seen are the saucy squirrels and the jay birds that gather round every camp from Maine to the Pacific. Sometimes one may start a covey of grouse, but he who depends upon his shot-gun will be apt to go hungry. It is a silent forest, so still one may almost hear plants grow; the wind passes far overhead stirring the tops of the giants, but unfelt in the "dim aisles below:" there are no rustling leaves, no chirping insects, no pattering raindrops; only growth—silent, progressive, life springing everywhere from decay. The natural question, how old is this forest, is not easy to answer. Individual trees, if we may trust the record of their yearly rings, are four hundred to six hundred years old, and they often stand upon the decayed trunks of others that may have taken twice that time to grow and moulder away; perhaps we may count fifteen hundred years in the still recognizable wood fibre. Back of that, we must depend on uncertain estimates based on the approximate thickness of vegetable mould and its rate of accumulation, estimates for which the data are very insufficient.

But though we may not count the centuries of the forest's existence, we can read something of the geological record of the time before it. The rocks of the Puget Sound basin are buried under an enormous deposit of gravel, at least three or four hundred feet deep, the grist ground out by glaciers much more extensive than those now found on Mt. Tacoma. About 1600 feet above the present sea level, these boulders form ocean terraces, the limits of the submergence that followed the cold period; and the cañons and river valleys cut since the gravels were deposited, tell of long and rapid erosion, before the forests sprang up; for, despite the great rainfall, the present erosion of the Sound basin is very slow on account of the protection afforded by the forests. This forest extends from southern Oregon northward to Alaska along the western slope of the Cascade range. It does not pass over the summit eastward and it is very different from the open park-like forests of California. Between the southern end of the Sound and Mt. Tacoma the timber belt is about 45 miles wide.

Several parties have, in the last fifteen years, followed up the Nisqually and Cowlitz Rivers to Mt. Tacoma, approaching it from the southwest, and they have left some record of their trips. Hazard Stephens, the son of Gov. I. I. Stephens, ascended the mountain in August, 1870, and spent the night in the crater; and, in October of the same year, A. D. Wilson and S. F. Emmons, of the U. S. Geological Survey, spent three weeks on the south and east, and also gained the summit. Stephens's account of his trip was published in the November Atlantic for 1876. His description of the night spent in the crater, warming one side by the jets of steam that issue from the crevices, while the other side was freezing in the icy blast, hardly tempts one to try the experiment. Yet his two companions repeated it last summer with Mr. George Bayley of San Francisco. There is no published account of Mr. Wilson's trip.

On the north and northwest, Mt. Tacoma is drained by three rivers, White River, Carbon River and the Puyallup. In 1833 Dr. Tolmie, superintendent of the Hudson Bay Company's trading posts on the Sound, made his way up the "Puyallipa," probably the present Carbon River, and ascended a peak on the northwest flank of Mt. Tacoma. This was the first approach of a white man to the mountain, and the point remained unvisited for 50 years: last summer, I was able to identify it and named it Tolmie's Peak. Some six or seven years ago, coal was discovered on a branch of the Carbon River; mines were opened by the Northern Pacific Railroad Company, and a railroad was built from Tacoma. But little was done, however, to explore the coal field and ascertain its limits until parties were sent out by the Northern Trans-continental Survey under the direction of Prof. Pumpelly. This work has not been easy; the pathless forest was exceedingly difficult to penetrate, and it requires a peculiar instinct to scent a coal vein buried under a superficial gravel wash and the mass of dead and living vegetation. It has often been a matter of wonder to me that the prospectors employed should succeed as well as they do. As the work slowly progressed, trails became necessary; permanent camps were built, and thus the wilderness was made habitable. At the end of two years we have pushed our exploration thirty miles south of Wilkeson and have traced the strip of Coal Measures, bounded on all sides by more recent eruptive rocks, to its southern limit. It is a peculiar fragment of the earth's crust, split by volcanic forces from its associates, and almost engulfed by the eruptions both east and west of it. Its sandstones, shales and coal veins are the record of thousands of years of slow, patient work by waves and plants; they lie at the base of one of nature's grandest monuments to the destructive earth-rending forces that buried Pompeii and made the gardens of Ischia desolate.

In carrying out the aim of our exploration, the development of the material resources of the region, we have incidentally called attention to the great beauty of its scenery. A trip to the glaciers, made by Mr. Oakes, vice-president of the Northern Pacific Railroad, and Senator Edmunds, last June, resulted in an order to search for a practicable route and build a trail up to Mt. Tacoma itself; and, in laying out that trail, we found new points of view, new scenes of wonderful savage grandeur, and others of lovely peaceful restfulness. Our main horse trail extends from Wilkeson, the end of the railroad, south to Carbon River, about nine miles, and then rises on to the divide between Carbon River and the Puyallup, here about six miles across from valley to valley. This range extends southeast, rising and narrowing until it joins

Mt. Tacoma. At 10,000 feet, it is a narrow comb between the heads of the Carbon and Puyallup glaciers. Up this mountain spur we built our trail. It leaves the main trail at an elevation of 3000 feet and follows for several miles a narrow ridge above the Puyallup River; then this joins a higher spur and the trail is forced to wind along the steep side hill, supported often by the trees whose roots firmly clutch the jutting rocks. After riding seven miles from the main trail, through the uninterrupted forest, we pass close beside the sparkling cascade of a mountain brook and enter a little meadow; an emerald set deep among the forest trees, under rugged precipices. The brooklet, that hurries by chattering "over stony ways in little sharps and trebles," leaps from the lake in the crater of Tolmie's Peak, 1300 feet into this valley; we named its source Tolmie's Lake and the stream itself Meadow Brook, with the thought that it loves these sunny pastures in the valley, with the memory of its Alpine home, where flowers deck the rock ledges in scarlet, purple and white.

Passing through two more of these meadow gems, the trail leaves the cascades of the brook on the left and winds up the southern side of the valley about 700 feet. Here, a mile south of Tolmie's Lake, another sheet of water ripples under dark precipices in the throat of one of the old volcanic vents. Under the nearer bank, the light green rocky bottom is visible, shading away to impenetrable darkness toward the centre. The dark surface reflects in perfect detail the sky and clouds, the trees on the farther shore, and the rocky needle that rises 1500 feet from the southern margin. Over the trees near the outlet, just to the right of this pinnacle, a pure white peak towers up into the heavens; it is the northern summit of Mt. Tacoma, the Liberty Cap. We sought for a name for this sheet of water in the origin of its basin and called it Crater Lake. It was once a lake of fire. Gaze down into its depths of a summer's day; they are dark and cold; the clear water laps upon the rocky bank, on the snow-drift dipping into it, while countless flowers rejoice in the warm sunshine; what a change since the fiery floods poured forth, devouring the valleys and mountains, out over the rich Tertiary forest, levelling all in the great slope from which the peaks and cañons of to-day are carved!

From Crater Lake, our trail passes on toward the glacier at the head of the Puyallup River and, after winding through the forest for a mile and a half, comes out on a jutting cliff from which you may drop a stone 1500 feet into the brawling river below. It is a fearful height to look from, and I do not wonder that a gentleman from Illinois who had never been on a mountain before, turned away faint and sat down behind a tree, with his back to the view, to recover himself. To your right, across the cañon as you look up it, are black precipices and snow fields ; to your left, the crags rise higher and higher behind the trees, and before you, a short mile distant, the north glacier of the Puyallup caps the cliffs at the end of the gorge. Its brown face is seamed with muddy rivulets and split by innumerable crevasses. It is about a thousand feet across and a hundred feet thick where the ice masses totter on the edge. Now and again they fall, shattering into a thousand pieces on the boulders of the terminal moraine. Back from its end the glacier slopes gently upward for half a mile, then rises abruptly 5000 feet in two miles and a half to its head, under yonder walls of rock and snow that support the gleaming Liberty Cap. There are certainly eight glaciers on Mt. Tacoma, perhaps ten or twelve ; I do not know exactly how many there may be on the southeast ; but, beginning on the northeast and counting westward, there are the glaciers of the White and Carbon Rivers, the two of the north fork of the Puyallup, the one of the south fork, that of the Nisqually and probably two of the Cowlitz River. If we would trace the formation of these glaciers we must go back to the snow flakes that fall on the triple summit of Mt. Tacoma from October to June. They fill every cranny of the rocks and round up every wrinkle in the weather beaten mountain, packing down closely to the shining snow mantle, that thickens with each winter's storms and lessens under the summer's suns ; it will be interesting to note, when the opportunities for observation permit, whether the ultimate result is an increase or decrease of this great névé. As the seasons pass, there is a steady downward movement of the compacted masses, and avalanche follows avalanche in those tremendous leaps of 1000 feet to 4000 feet from the cliffs that gird the mountain. After lingering for months on its shoulders, the snowy particles dash down with a roar, whirling in the wild eddies of their own fall, plunging down, down on the glaciers below. It is but an instant of intense energy, the transition from months of quiet in the great snow cap to years of resistless march in the ice mass of the glacier. The solidification of the snow into clear ice which marks the change from névé to glacier, usually takes place at the foot of these falls at an elevation of 8000 feet to 10,000 feet; but one glacier, that of the Nisqually, begins higher on the mountain. The five glaciers on the northern and western slopes, with which I am familiar, all have a very rapid fall. Their downward paths are rugged and the crystal ice breaks into a thousand pyramids on the hidden declivities beneath it. But it flows ever onward, now opening deep crevasses, now uniting, now spreading out, now narrowing in, as its banks require, a plastic mass of rigid material. The lower ends of these glaciers differ widely in their elevations above the sea. White River glacier, one of the largest, if not the largest on the mountain, descends with a gradually lessening slope and ends upon an open grassy plain amid brilliant colored flowers, at an elevation of about 3500 feet, perhaps a quarter of a mile from the narrow cañon, into which its river plunges. The glacier of Carbon River descends through a gorge to about 3300 feet above the sea; protected by the cliffs from all but the morning sun and having great bulk at its upper end, it descends lower than any other that I know of; at its end it is about 300 feet across and fifty feet thick. The north glacier of the Puyallup breaks over a cliff and slips away in muddy rivulets five thousand feet above the sea; and the south glacier, having much less impetus and volume, ends in the narrow cañon of the river at 4300 feet. Of the other glaciers I cannot speak of my own knowledge.

Turning from the mountain's icy coat to its fiery origin, there is an interesting question suggested by the three summits. They lie in a semi-circle, the opening to the west; did they once form the eastern half of a huge crater; is the mountain but a part of its former self? The only crater now recognizable on the summit, I am told, is that on the eastern side of the Dome; it is slightly inclined to the east and its western rim forms the highest point on the mountain. I have seen it from a distance, a black ring of rocks always kept bare by the hot stream still issuing from the crater's edge. There are four other craters north and northwest of Mt. Tacoma on its lower slopes; all between 5000 feet and 6000 feet above the sea. The first is in Crescent mountain, a distinct peak due north of the Liberty Cap. The second is filled by Crater Lake; the third lies half a mile east and the fourth is in Tolmie's

Peak. I first visited the latter early last July. There were three of us in the party. We had left the stationary camp, the Palace as it is called, at seven in the morning and were glad enough, at the end of thirteen hours' tramp with our packs on our backs, to light our camp fire on a grassy spot among the snow drifts by Tolmie's Lake. The water was still covered with snow-ice, and the columnar cliffs on the far side were topped by overhanging snow masses. We camped on the southern edge of the crater, between the lake and the precipices over which Meadow Brook falls 1300 feet into its lower valley. Across the valley were the slopes of Mt. Tacoma, while to the eastward we looked down into Carbon River cañon from which mountain peaks rise in stupendous walls, crag upon crag. In chopping fire wood, we found trees cut by Dr. Tolmie, fifty years before, and Indian baskets left by his party. After enjoying our bread and bacon, we each rolled up tightly in a single blanket and tried to sleep. Toward midnight, the full moon stood high in the clear heavens. Against the dark metallic sky, from which the stars stood out in relief, the black crags were dimly visible ; above them rose indistinct gleaming snow slopes, like the reflection of moonlight on rippling water, higher still and higher to Tacoma's summit. The great shining peak hung like a phantom above the abyss of darkness ; the one, pure, bright, ethereal ; the other, deep, immeasurable, a gulf of dread. Through the frosty air pulsated a roar like that of a great city, the mingled voices of a hundred waterfalls. The moon passed on and paled before the growing light of day. The mountain reached out great ribs of rock and snow and took its stand in the depths of the chasm. The morning star shone brilliant in the eastern sky, and a blush touched the beautiful summit. It spread and passed down, leaving a golden spire in the heavens ; and, as the rosy zone descended over forbidding precipice and icy pinnacle, they melted into fairy land. A veil of opalescent mist enveloped the mountains, and the sun rose upon an enchanted world.

THE MIGRATION OF BIRDS.

By ALEXANDER O'DRISCOLL TAYLOR.*

Mr. Taylor pointed out the old meaning of instinct, which indicated a supposed mysterious impulse by which the lower animals, independent of instruction and experience, were directed to do what was wisest for the individual and species, as opposed to reason in man, that faculty by which absolute truth was perceived, by which one proposition was deduced from another, and by which ratiocination was carried on. He then explained how fuller light had been thrown on this subject by Darwin's great work on the "Origin of Species," and quoted extracts which had not before been laid before any American audience, from a posthumous essay on "Instinct" by the great Darwin, read lately before the Linnæan Society in London.

Turning to the special theme of the evening, the "Migration of Birds," he traced the annual course of feathered migrants both in Europe and America, pointing out that, in the former region of the world, their course was definitely marked, and lay over the lines of submerged land at the three places where they regularly cross the seas. He contended that the migratory instinct had been developed by unconscious hereditary teaching, which preserved in the birds the memory of these lost land connections, and kept in existence from generation to generation, a salutary habit which want of food and of space to rear their young, had originally initiated in birds, probably after the glacial period, hundreds of thousands of years ago. In discussing the intellectual powers of birds, he stated some most curious facts about the æsthetic tendencies of the Bower Birds of Australia, which species ornament their halls of assembly with great taste, apparently for the mere love of beauty. The accurate knowledge of direction possessed by birds, as well as their special powers of imitation and their capacity for music, were also mentioned. In connection with the birds of America, the curious fact was adduced that the beautiful Humming Birds, which visit us here in summer, are really descendants of the Swifts and Swallows. The young of the Humming Bird would starve if you tried to feed it on honey alone, for Humming Birds are really insect-eaters far more than honey-suckers ; and the young birds are only, in their tender, youthful stage, immature Swifts, and must be fed accordingly. Finally, it was argued that this migratory instinct was not a forced, immutable, perfect law, but an imperfect, improvable, and gradually acquired method of adjusting action to the surrounding conditions.

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*Abstract of paper read before the Society on Jan. 3d, 1884.

Mr. Taylor's closing remarks are given in full ; he said : "I have now sought to give you some facts which will enable you to answer to a certain extent, the query which I have adopted as the title of this paper, namely : 'What does the Migration of Birds Mean ?' It means much. It means that far back in the dim ages of the past, long before man appeared in a world which he seeks in vain to comprehend, there lived and flitted in the sunshine of southern climes, a happy tribe of winged creatures, whose descendants, century after century, perhaps æon after æon, wandered away in search of wider, safer and more bountiful resting places. It means, that by inheritance and selection, the memories of those wanderings deepened and deepened in those birds ; while climate and altered surroundings modified many of their forms, as slowly but as surely as the ocean waves and the frost alter the silent rocks. It means, that not alone from the strata which lie beneath us and which chronicle the geological changes in the formation and surface of this earth from age to age, but also from the birds which every summer flash from distant regions, flooding us with song and dazzling us with beauty, do we gather impressive and significant teachings of the mighty past. These migratory birds are living letters of nature, which write, in unmistakable characters, the history of ice-barriers long melted away, of submerged continents, of altered and altering climatic conditions. They further record, in these annual migrations, the persistence of habit, the accumulation of experience, the tendencies of heredity, and, it may be, in those actions which we do not yet understand, they preserve the memory of special incidents which once deeply affected the feathered race, but of which we never heard or dreamed. Surely such a view of migration in birds surpasses, in its reach, the old idea which simply regarded this power as a mysterious one, unfathomable, and given by the creative Intelligence to birds as a special gift. Concurring thoroughly with the spirit of William Cullen Bryant's beautiful "Lines to a Waterfowl," I feel that

> "There is a Power whose care
> Teaches thy way along that pathless coast;
> The desert and illimitable air,
> Lone wandering, but not lost."

Most assuredly do I believe that there is an ineffable Power guiding the solitary bird along his pathless way. But, instead of holding that the instinct was implanted as an entity by the Almighty, in an arbitrary, isolated fashion, I believe that its origin took place millions of years ago; and, in conformity with the laws of development, which I see manifested in all other tribes of animated beings, that it has, by infinitesimally small accretions, strengthened and grown into its present maturity. Such a view, recognizing as it does the reign of law throughout all creation, fills me with thoughts too deep for words, as year by year I gaze upon these feathered migrants, and profoundly deepens in my conviction, the recognition of a Creator infinitely more wise, infinitely more powerful, and infinitely more patient in the development of both organic and inorganic nature, than the mind of man can conceive."

A TRIP THROUGH NORTHWESTERN WYOMING.

By A. D. WILSON.*

Mr. Wilson commenced by giving an outline of the geological formation and general features of the Wind River mountains, which lie at the northwest corner of Wyoming, extending to the borders of Idaho, and running south of the Yellowstone Park. Mr. Wilson, in the year 1878, was in charge of a small party belonging to the United States Geological Survey, who were then making a topographical examination of this little known part of the country. His party followed a route from Point of Rocks station on the Union Pacific, northward through the Wind River mountains, afterwards striking the Teton mountains, thence through a singularly wild defile into the Yellowstone Park. The Wind River mountains consist geologically of later formations at the base, but of granite and Gneiss through the main range and along all the summits. Glaciers still exist throughout this region, and their past action is plainly seen in the peculiarly scooped granite basins, now occupied by lakes, and also in the great quantity of morainal matter carried out into the valleys where it is now accumulated in picturesque shapes, piled in some cases to the height of 1000 feet above the valleys. Deeply cut cañons exist at all points of the range, with almost perpendicular walls running up to fully 2000 feet. The mountains themselves are very jagged and bare of vegetation, but the slopes at the foot are covered with pine timber. Deer and elk abound along the valleys, which are traversed by streams full of trout, while in the hill ranges grizzly bears are plentiful.

Mr. Wilson ascended Fremont's Peak and other notable points, and gave a vivid description of the dangers and almost unsurmountable difficulties attending such mountain climbing. Though it was July when the little exploring party made their journey, they found the mountain lakes they had to cross, so thickly frozen that they were able to cross from point to point on foot. Following the march, they next came to the

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*Abstract of lecture delivered before the Society, on February 8th, 1884.

Teton range, where Mr. Wilson had a personal interview with four grizzly bears, father, mother and two cubs nearly as large as their parents. He shot the parents and then found he had run out of cartridges. The bereaved children roared and bellowed, but fortunately did not see the assailant who was concealed behind some rocks, from which he made his way as quietly as possible, not wishing any further explanation with the surviving members of the family.

Leaving this range of mountains, the party made their way through a valley densely covered with timber, in an open part of which they discovered a series of small lakes, which were literally alive with water-fowl. This sequestered locality was evidently the breeding-place of vast quantities of birds, such as wild geese, various species of ducks, large white swans and cranes, all of which made an almost deafening noise by their various cries. This bedlam of noises was in striking contrast with the gloomy and silent forest all around.

Passing up Henry's Fork, a branch of Snake River, the party struck a large trail which they supposed to be that of a troop of United States cavalry, which they knew at that time was scouring the country in pursuit of hostile Indians of the Bannock tribe. In this supposition, unfortunately, after-events proved they were incorrect, for the trail was really that of an Indian war party who had stolen horses from the government and were retreating towards the Yellowstone. Mr. Wilson's party, when camped that night on the banks of Henry's Fork, were attacked by these Indian marauders, who riddled their tents with rifle shots and captured their horses, but Mr. Wilson and his four companions succeeded, under the cover of darkness, in escaping to the forest by wading the river. The party were now entirely deprived of food and had to make their way on foot about 75 miles through a forest, where they were exposed at any moment to fresh attacks from the Indians. However, their guns supplied them with provisions, and their quiet determination brought them at last to the Yellowstone Park, on the borders of which they met another division of the United States Government Survey, who had gone in a different direction. Procuring two horses, Mr. Wilson and one companion returned in the hope of recovering their topographical instruments which they had hidden in the bush near the point where they had barely escaped with their lives from the Indians. In this quest the two were successful.

Mr. Wilson then described the general appearance of the Yellowstone Park to which he subsequently made his way again. Its boiling springs and geysers and the Mammoth Hot springs were spoken of, and their peculiar configuration. Amongst other incidents, the lecturer described a very extraordinary electric storm in which he and his assistant were caught when engaged in making topographical observations on Electric Peak,—a mountain over 11,000 feet high, situated at the northern edge of the Park. The thunder clouds rolled up from the valleys and cañons below, and enveloped the two observers, while flashes of lightning struck various points around them. Mr. Wilson described the electricity as producing a tingling sensation at the roots of the hair, then making their pencils click with a sharp sound, as they recorded their notes; while from the brass instruments and pointed rocks musical sounds were emitted, which might have been heard fifty yards away. It seemed a strange burst of mountain music gushing from everything around, but evidently produced by the mysterious touch of the dark thunder clouds. Mr. Wilson and his companion had to run at last and find shelter amongst some rocks. The peak they had been on was struck by a thunderbolt within a minute after they had left it. Mr. Wilson's return march was southward from the Yellowstone Park to Rawlings, a small town on the Union Pacific line.

THE BIRDS OF NEWPORT.

By WILLIAM C. RIVES, Jr., M. D.*

Before we consider the birds of Newport in particular, a few general observations on the ornithology of our country may perhaps be of some interest.

Until a comparatively recent time, the chief writings of importance on North American birds and their habits were those of Wilson and Nuttall, and the magnificent work of Audubon, who, from his constant familiarity with our birds in their native haunts, and his peculiar skill in representing them in life-like and characteristic attitudes, has produced a set of plates unrivalled, I believe, for their beauty and truth to nature. For many years after the publication of these treatises, few works of importance appeared, but a gradual accumulation of facts was taking place, and many separate papers of more or less value were printed in the transactions of different societies, while much ornithological matter of great interest was, from time to time, contained in the reports of various government exploring parties.

In its contributions to the knowledge of our birds, New England has always taken a prominent position, and the "Birds of New England" by Edward A. Samuels, was perhaps, the first readily accessible volume on their life histories which has been published within the present half of this century. The purely technical descriptions contained in this book are taken from a very important account of the birds of North America, published in the ninth volume of Pacific Railroad Reports in 1858, by Professor Spencer F. Baird, of the Smithsonian Institution, but which is confined merely to descriptions and does not deal with their habits. Another important work, limited to the same subject as Professor Baird's, is the "Key to North American Birds," by Dr. Elliott Coues, which was first issued in 1872.

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*Read before the Society, March 6th, 1884.

Since the appearance of Samuel's book in 1867, there has been a great increase in the interest taken in the study of American Ornithology, and books and papers have appeared too numerous to mention, with the exception of a few of the most important. In 1870 was published by the Geological Survey of California a volume by Dr. J. G. Cooper, on the ornithology of the west coast of America, which Professor Baird calls by far the most important contribution to the biography of American birds since the time of Audubon. In 1874 the first three volumes were issued of the great work of Baird, Brewer and Ridgeway, on North American birds—a work which will long remain the standard authority upon the subject. The first two of these authors were friends of Audubon, and new species were named by him in their honor. The two remaining volumes on the water birds are now passing through the press, and will be published as a part of the ornithology in the Geological Survey of California, just mentioned, and will also appear in the Memoirs of the Museum of Comparative Zoology. The source of a great part of the information contained in these volumes has been the very copious notes and valuable collections in the possession of the Smithsonian Institution.

According to Professor Baird, "before the appearance of the work of Audubon (who went himself, however, to the Upper Missouri in 1843, and met there with a few new species,) nearly all that was known of the great region of the United States west of the Missouri river, was the result of the journey of Lewis and Clarke up the Missouri and across to the Pacific coast, and that of John K. Townsend and Mr. Nuttall, both of whom made some collections and brought back notices of the country, which however they were unable to explore to any great extent. The entire region of Texas, New Mexico, Colorado, Arizona, Nevada and California was unvisited, as was also a great portion of territory north of the United States boundary, including British Columbia and Alaska."

The ornithology of those regions is now no longer unknown, and fresh information is constantly added by numerous observers, often army officers and those engaged in the government surveys, but, owing to the vast extent of our country, there still remains much to be done and plenty of interesting and important facts to be ascertained about the local distribution, times of arrival and departure, and other habits of our birds, even in regard to those of the Atlantic coast. The water birds, in particular, have been much less carefully studied than the land birds.

To show what may be done by close observation, I may mention that Mr. C. J. Maynard discovered an entirely new species, the Ipswich Sparrow, among the Ipswich sand hills in Massachusetts as recently as 1868 ; and birds new to particular localities are constantly discovered—thirty-five, for instance, having been added to the Massachusetts list since 1867.

The American Ornithologists' Union, formed last September, have appointed a committee on the migration of birds, and have issued a series of questions to be answered by any one who is willing to make observations on the birds of his particular locality—a step which will doubtless result in the collection of a mass of information of great interest.

Southern New England, I believe, has been less carefully studied than the more northern parts—than eastern Massachusetts in particular, and the birds of Newport offer still an interesting field for observers. It has been found by numerous observations, and the fact has been thus expressed by Dr. Coues that " any one United States locality of average attractiveness to birds has a bird fauna of over two hundred species and, if it be away from the sea coast and consequently uninhabited by marine birds, about one fourth of the species are comprised in the two families of the *Sylvicolidæ*" (or Warblers, a family of insectivorous birds—small, but often of almost tropical brilliancy of plumage,) "and the *Fringillidæ*," (the Sparrows and Finches, which for the most part are granivorous). In larger districts—such as a whole state or section of the country—this number is of course much exceeded. The most recent list of the birds of Massachusetts that I know of, gives the number as 316. The number of the birds of New England is 361. I do not know whether any list of the birds of Rhode Island has yet been published.

The total number of North American birds north of Mexico and including Greenland and Alaska, is 888 as given by Dr. Coues in his list of 1882. As to the numbers in which the birds are found, there is of course every gradation, from great abundance to extreme rarity.

In New England, many species have greatly diminished since the colonial times and some have become extinct. The Pinnated

Grouse or Prairie Hen, once very common all over this part of the country, is now no longer found east of the Ohio river, with the exception of a few which, I believe, are still in existence on the islands of Martha's Vineyard and Naushon. That very curious extinct bird, the Great Auk, referred to by early New England writers as the "Pengwin" or "Wobble" is supposed to have been found along the coast from Cape Cod north, and its bones have been discovered among the Indian shell heaps of the Ipswich sand-hills.

The Wild Turkey, which is now no longer known here, was very plentiful in former days—as appears from the following passage in Morton's New English Canaan published in 1632: "Turkies there are, which divers times in great flocks have sallied by our doores. Of these there hath bin killed that have weighed forty-eight pound a peece. I had a salvage which hath taken out his boy in a morning and they have brought home their loades about noone. I have asked them what number they found in the woods, who have answered Neent Metawna, which is a thousand that day, the plenty of them is such in these parts. They are easily killed at rooste because the one being killed the other sit fast neverthelesse, and this is no bad commodity."

From these general remarks, I now come to the birds of our own particular locality. Owing to its insular position on the coast, and the comparative absence of trees, Newport is not very attractive to many of the land birds, especially those which frequent deep forests, but nevertheless, a large proportion of the birds which are found in other parts of New England are met with at least occasionally. Beginning with the birds of the winter months, one of the most familiar species which is to be seen frequently in the streets in this immediate neighborhood is the Black-capped Titmouse, or Chickadee, a sprightly, impertinent little bird, very active in its movements, and seeming to enjoy even the severest weather. These birds breed here, and may occasionally be seen at all times of the year, but are much commoner at this season. Often found in company with the Chickadee is another diminutive species, the Golden-crested Wren, a bird of a rather dull plumage, except for a bright yellow patch upon the crown. It is somewhat like the Chickadee in its movements while searching for food upon the branches, and utters a feeble, lisping note. This is one of the smallest of American birds except the

Humming Bird, and it is worthy of remark that its breeding habits have been wrapped in considerable obscurity ; for, notwithstanding that it is very abundant in winter, no discovery of its nest was reported until 1875, when Mr. H. D. Minot, of Boston, found one, containing six young, in the White Mountains, in the month of July. The Meadow Lark, Golden-winged Woodpecker and Crow, all well-known birds at other seasons of the year, remain with us during the winter, although they abandon the more northern parts of New England. Besides the common birds I have mentioned, we find winter visitors which spend the summer very far north, for instance the Snow Buntings and Shore Larks which are not uncommon in the bare pasture fields near the ocean and are often found in each other's company. The Snowy Owl, another beautiful northern bird, is not very rare here, and in the winter of 1876-77 was unusually abundant in New England.

This year we have been visited by a bird known as the Pine Grosbeak which inhabits the evergreen forests of the extreme northern parts of New England and is not usually found farther south. I cannot recollect ever having seen it before, but this season I have observed birds of this species on several occasions in Red Cross and Rhode Island Avenues. Mr. B. LaFarge tells me that he too, has met with them, and Mr. Jencks, a Providence ornithologist, reports them in numbers from that city and its neighborhood. Very curiously, as has been noticed in other years when this Grosbeak has been plentiful in New England, almost all the birds are females and young, as we judge from their dull plumage. The full plumaged male is a very pretty pink bird, but Mr. Jencks says that he has only known of three being killed this winter, and, among the considerable number of Grosbeaks which I have seen, I caught a glimpse of only one which seemed to be an adult male. This bird is identical with the Pine Grosbeak of Europe, but no positively identified American eggs exist, I believe, in collections—except two found by Mr. Boardman near Calais, Maine, which are supposed to have belonged to this species, although the parents were not seen. During their visits to us, these birds seem very tame and have been caught and kept in cages. The cause of their sudden migrations is supposed to be want of food to the northward. Another species, occasionally seen at this season, though usually arriving somewhat later, is the beautiful little Cedar Bird, with its crested head and its wing feathers with horny tips like red sealing wax. These birds, as well as the Purple Finch which is also sometimes seen at this time of the year, remain to breed. Among our other winter birds are the little Brown Creeper, which may be often seen in the streets soberly and industriously running up the trees in search of food, an occasional Downy Woodpecker, the smallest of its family to be found here, which sometimes disturbs the stillness of this season with its sharp rapping, the Snow Bird and several Sparrows besides the English Sparrow which also seems able to survive the cold.

About this time in March, we may expect the arrival of the Blue Birds and Red-winged Blackbirds, soon followed by the Robins and several species of Sparrow, though Robins have been seen this year in February and may very likely be found even during the coldest weather in December and January in the thick growth of trees and bushes among the Paradise rocks back of the Second beach. The rest of the migratory birds soon follow, the greater number arriving at different times in April and May—the males of many species arriving before the females.

Among our migrants, the family of *Sylvicolidæ* or Warblers contains many interesting species differing very remarkably from each other in their abundance, extent of migrations and habits; of the genus *Dendrœca*, of which we have in New England more species than of any other, there are three which I know visit us, and several others may probably be found. One is the very abundant little Yellow Warbler, which is to be seen in the town wherever there are shade trees, and which has rather a monotonous, piercing, not very pleasant song. It is a small bird, entirely of a deep yellow color, with a few faint brownish streaks upon it,—not to be confounded with the common Yellow Bird or American Goldfinch, a larger bird, with plumage of a lighter shade of yellow, which may be at once distinguished by the black of the wings and tail and which is often seen eating the seed of the thistle, while the Yellow Warbler is insectivorous and frequents the tree tops. The other two Warblers I referred to, are the Golden-crowned and the Black Poll Warbler: the latter is always the last of the spring migrants to arrive.

Among the *Sylvicolidæ*, which breed here, I learn from Mr. LaFarge, are the Maryland Yellow-throat, a pretty Warbler, which frequents swampy thickets, the Black and White Creeping Warbler, and the Oven Bird, so called from the curious nest, with an arched top, which it builds on the ground, and which is supposed to resemble an old-fashioned oven.

Of the Thrushes, besides several other species sometimes met with, we have that general favorite, the Robin, which is, as we all know, very abundant on the lawns. We are all familiar with its liking for earth worms, but it is probably not known to everyone what an extraordinary number it eats. Professor Treadwell of Cambridge, found that a young Robin he kept in a cage for some time seemed to languish, and did not begin to increase in weight until it was provided with sixty-eight worms daily. On the day when it first eat this number, the bird weighed twenty-four pennyweights before his meal. The weight of the worms was thirty-four pennyweights, so that in twelve hours it eat forty-one per cent. more than its own weight.

Of the family of the Vireos, among the very best of our singers, birds which are found in the tree tops and build very beautiful nests, we have the well-known Red-eyed Vireo, the White-eyed Vireo and the Warbling Vireo, and other species may perhaps occur. Both kinds of Cuckoo, common to eastern North America, are found here in summer and breed—though not abundantly. There is one bird which is common here that always lays its eggs in the nests of its neighbors. This is the Cow-blackbird or Cow-bunting.

Among the best known of our summer birds are the Swallows. We have the Barn Swallow, the White-bellied Swallow, the Bank Swallow, the Cliff Swallow and the Purple Martin. All of these varieties, including the so-called Chimney Swallow, may be seen at almost any time in summer—hovering over the marsh back of the beach, where there is an ample supply of their insect food, the White-bellied being perhaps the most abundant and the Purple Martin floating high in the air above them all.

The very remarkable family of the Humming Birds is peculiar to America, the West Indies and neighboring islands, and comprises nearly four hundred species, though of that number hardly more than a dozen are at present known to occur north of Mexico. Several of them are very limited in their range, some being confined to particular islands and others to the tops of certain mountain peaks. The Chimborazo Hill Star Humming Bird, for example, is found only upon that volcano, at an elevation of from 12,000 to 16,000 feet, up to the edge of the snow line, and upon the neighboring volcano of Pichincha only thirty miles distant, is found a distinct species which is peculiar to that mountain alone.

The flight of the Humming Bird differs from that of all other birds, and resembles, as we all know, that of the insects, the wings moving so rapidly that it is impossible to see the separate vibrations. Almost all of them are endowed with the most wonderful brilliancy of plumage, which glitters in parts with a metallic lustre and varies in color according as the feathers are viewed in front or obliquely, so that these birds are able by their movements to change their hues. The Rufous-backed Humming Bird of the Pacific coast, for instance, is said to change the color of its throat from a fire tint to a light green. The only species found in eastern North America is our little Ruby-throat which breeds from Texas to high latitudes. I should mention, however, that a specimen of Linnæus's Emerald, a South American species, was captured in 1864 at Cambridge, Mass., the cause of whose presence there has ever since been a mystery to naturalists. Any one who has a trumpet creeper or plant with tubular flowers is sure to see a Ruby-throat about it during the summer, and I understand that its nest has been found on the Island.

Frequenting the beaches and the marsh back of the beach, quite a number of interesting birds can be found. At almost any time in late spring and summer, walking by the edge of the pond, you may hear coming from among the thick reeds a peculiar trilling song, difficult to describe, but which, after it is once heard, cannot be mistaken. This proceeds from the Long-billed Marsh Wren, a little bird which is quite common, and which builds one of the most curious of American nests. It attaches to the reeds a coarsely woven structure more or less spherical in shape, like a large ball with a hole in it on one side for the bird to enter. Mr. LaFarge has found the nest of a closely related, but much rarer species, the Short-billed Marsh Wren.

Besides these Wrens, I will mention in particular two other birds found among the reeds and frequently shot by sportsmen, which are much commoner than is usually supposed. These are the Common Rail, called in Virginia the Sora, and the

Virginia Rail. These birds will always run in preference to flying, and keep themselves carefully hid in the reeds, so that they are not often seen unless specially sought for. Both kinds breed here, but they are more abundant about the first of September when their numbers are increased by the return of those which have passed the breeding season farther north. They are sensitive to cold, and usually, on the occurrence of any severe weather, all disappear. This disappearance is so very sudden,—sometimes not a single Rail being found after a severe frost in places which the day before were swarming with them,—that some startling theories have been advanced to account for it, one of which is that the Rail buries itself in the mud and remains torpid until the following spring, the other, that they turn into frogs. It is hardly necessary to refute these statements, and it is known that these birds regularly migrate and have been met with by ships at a distance of several hundred miles from land. By the end of October the greater part of them have left Newport, though I have seen one as late as the second of November.

I must pass over many interesting birds, merely mentioning the names of the King Bird, Night-hawk and Baltimore Oriole, all of which breed here, and now come to the shore birds of which there are very many varieties. We have two kinds of "Peep" which are very abundant, the Least or Wilson's Sandpiper and the Semipalmated Sandpiper; their general appearance is much the same, but the latter is distinguished by having the toes semipalmated or half webbed. Then, there is the Pectoral Sandpiper, always known as the Creaker, from its peculiar cries, a bird which is found on the salt marshes, and rarely if ever on the beaches. The Sanderling Sandpiper, on the other hand, frequents the beaches rather than the marsh, and may be often met with on the Second beach. It differs from the other Sandpipers in having no hind toe, in which respect it is like the Plovers. The largest of our Sandpipers is the Red-breasted Sandpiper or Robin Snipe which is a somewhat rare species and is identical with the European bird called the Knot. Belonging to a sub-family by themselves are the Willet, a comparatively rare species here, the well-known Yellow-leg, and the Great Yellow-leg. Of the Plovers, we have the Golden Plover or Greenhead and the Black-bellied Plover usually, I believe, called Black-breast or Beetle-head. The little birds called Ring-necks, which are nearly as common as the Peeps, also belong to the Plover family. We have two of them, the Ring Plover and the Piping Plover, and also an allied species the well-known Kildeer. The first of them is rather the commoner and may be seen almost anywhere along the shore, while the Piping Plover is often found on the Second beach. The much sought after Grass Plover,—now no longer common here—is usually classed with the Sandpipers. Of the Curlews we have the Long-billed Curlew or Sickle-bill, a large bird with a bill a foot long, the Hudsonian or Jack Curlew, and; if I am not mistaken, the Esquimaux Curlew or Dough Bird has also been shot here.

The two varieties of Godwit or Marlin are met with rarely. Then we have the Turnstone which frequents the rocky shores and rejoices in the various names of Rock Plover, Brant Bird, Horsefoot Snipe and Calico-back. A good many of these birds make a very brief visit to us in spring on their way to their northern breeding places, but are more abundant and stay much longer on their return when they are with us during the months of August and September and are much sought after by sportsmen. The best place for shooting most of them is the marsh at Easton's pond, as the larger species are not often found upon the beaches. The usual way of obtaining them, as is well known to many of those present, is for the sportsman to take a basket of wooden or tin decoys painted to imitate the different species, and before day-break to go down to the marsh and choose one of the pond holes, often however to find it previously occupied—as even at that early hour there is great competition. If, notwithstanding, he succeeds in obtaining a place, he puts out his decoys in the water, fastened upon sticks and, making a blind to screen himself, sits down behind it with his back to the wind—regardless of the mud and the mosquitos. His patience is often greatly tried as sometimes for hours there is nothing to be heard except perhaps the peculiar squeaking cry of a Rail or the dip of a Swallow as it touches with its wing the surface of the water, but, at other times, particularly at the moment when the sun begins to color the eastern sky, a distant whistle is heard. The sportsman seizes his gun which has been lying idly by his side, crouches down and begins to whistle in return, and gradually the sounds come nearer and a flock of some variety of shore birds is seen approaching. All the sportsmen on the marsh vie with each other in attempting to entice the unlucky birds, but as they almost invariably come over the hill from the direction of the Second beach, those who have taken their stand at the eastern end of the marsh usually get the first shot. The birds in the meantime have been answering the whistles and, when they see the decoys, will usually come flying towards them and when near set their wings, drop their long legs and sail down uttering their shrill cries. The sportsman then takes advantage of the opportunity and often brings down a good many at a single shot. By far the most abundant of the species which may be decoyed in this way, is the common Yellow-leg. These birds are frequently so tame that they may be whistled up a second time and, after losing several of their number at one stand, will often go to another. They are never seen here in the great numbers described by Audubon who speaks of one hundred and six being killed at a shot, on Long Island.

The Golden Plovers or Greenheads are usually decoyed in the bare pastures and not on the marsh, but, although numerous some years ago, they are now I believe not common.

The Red-breasted Snipe known as the Brown-back or Dowitcher, which I omitted to mention, is another species much sought after by sportsmen and is very easily decoyed. It resembles in shape, though not in plumage, our Common Snipe. I have heard an explanation of the singular name of Dowitcher applied to this bird which seems very plausible; the Common Snipe which is very closely related to its European brother, though not identical with it, is always called the English Snipe, and some one out of compliment to our German population is supposed to have distinguished the species in question by the name of the "Deutscher" or German Snipe. Our so-called English Snipe is not uncommon here; like the Grass Plover it cannot be decoyed and is never met with in flocks. It is a difficult bird to shoot on account of its peculiarly irregular and rapid flight.

The greater number of the shore birds I have mentioned rear their young in the far North, but there is one little bird that breeds here in abundance, the Spotted Sandpiper sometimes called Peet-weet from its ordinary cry or Tip-up from its peculiarity of rocking itself backwards and forwards, a habit often indulged in by the Yellow-leg. These Spotted Sandpipers keep by preference to the rocky and pebbly shores and are very common along the Ocean drive. They are never found in flocks and have a characteristic flight which enables one to identify them at a long distance. They lay four eggs, which, like the eggs of the Sandpipers in general, are very large in proportion to the size of the bird.

There are several species of Heron which visit Newport in summer, first the American Bittern which I have met with on the marsh at Easton's pond, then the Night Heron which a few years ago might be seen in early summer standing in meditative attitudes on the edges of the Dumpling rocks, while ever on the alert to capture a passing fish, but which seems to have disappeared from them the last year or two. Tnen there is the common Green Heron and a very curious little species, the Least Bittern, which, though resembling in many of its habits others of its family, hides itself among the reeds like the Common Rail. It is very rare in other parts of New England, but is not uncommonly met with here. Mr. LaFarge, who has found several of their nests, tells me that on one occasion he was able to approach so closely to one of these birds which was sitting near its nest as to stroke it with his hand, and at Lake Koshkonong in Wisconsin where these birds are very common, I have known of one lighting for an instant on a dog's back.

Those very curious birds, the Phalaropes, have also been shot here; they are members of a family of birds which resemble miniature ducks, as they light upon the water and swim with perfect ease, though they walk about also on marshy ground or floating vegetable matter. A specimen of the Northern Phalarope was shot by Mr. F. W. Rhinelander, Jr., August 30th, 1876, and a Wilson's Phalarope was shot by Mr. F. T. Jencks, August 2d, 1880. The Phalaropes usually keep off the coast while migrating, and seldom are met with in New England unless they have been driven in by a storm.

In September the Ducks and many other web-footed birds begin to appear and remain until May, a few being sometimes seen even in summer. Of the fresh water Ducks, some of which are found however in the bay, we have the common Black Duck, an excellent bird for the table. It is wonderfully shy and to decoy it successfully one must be very carefully and entirely concealed.

The Blue-winged and Green-winged Teal both visit Easton's pond,—the former being much the commoner. The beautiful Wood Duck, a bird found all over the continent on the fresh water, is sometimes seen here. Several other varieties are more or less common. Of our sea Ducks, among the commonest and best known is the Long-tailed Duck, always called here the Old Squaw. It is a handsome black and white bird remarkably swift flying. These Ducks are shot at the Dumplings from row boats at sun rise when they fly up the bay often in immense flocks, and also at sunset when they return. They are very tough, often escaping when wounded as they can dive like a fish. Samuels, in his "Birds of New England," mentions knocking seven out of a flock without getting one.

Then we have several species, commonly called Coots, though they are not Coots at all, the true American Coot being a lobe-footed bird, which is to be seen on Easton's pond in small flocks in autumn, and, I believe, is never found on salt water. Of these so-called Coots however, we have the Surf Duck known as the Patch-poll Coot, the American Scoter Duck or Butter-bill Coot, and the Velvet Duck—a large, handsome species, called, from the white patch on its wings, the White-winged Coot. Some of these Coots sometimes collect in large masses in the shoal water at Brenton's Reef, or off Easton's Point. Rare species are occasionally found here. The celebrated Eider Duck has been shot, as well as the Canvass-back and Red-head, and the rare King Eider has been obtained this winter up the bay.

Wild Geese are often seen passing over, uttering their loud "honking" cries—always flying in the shape of the letter V, with one or two old ganders leading them. Their migrations extend to the furthest northern regions, and flocks have been seen within the Arctic circle, still pursuing their way towards the pole. They hardly ever stop here, but are known to have done so on a few occasions. They are frequently domesticated, and I have seen a large flock of them which had become very tame. The Brant Goose is here of extremely rare occurrence.

Plenty of marine birds, besides the Ducks, are found upon our waters. An abundant species is the Great Northern Diver or Loon, a bird about as big as a goose, remarkable for its extraordinary powers of diving and swimming under water. It dives instantly at the flash of a gun and comes up again several hundred yards off, after being under water a minute or more. Besides being common on the sea coast, this bird is almost always to be seen, in small numbers, on the lakes of northern New England and New York, where it is known to breed.

We have also numerous varieties of Gulls and Terns, the latter being usually called Mackerel Gulls. In summer there are the Common Mackerel Gullor Wilson's Tern which breeds plentifully, and several other species, while the larger Gulls are seen more particularly in the colder months. Stormy Petrels or Mother Carey's chickens are found as well, the particular variety being probably Leach's Petrel.

The Cormorant, a shy bird, very expert at catching fish, is common in winter. The Shearwaters, a family of birds resembling the Petrels, are met with off the coast. Specimens of the Little Auk and the Puffin, if I am not mistaken, have been found here, and several of the birds called Brünnich's Guillemot have been shot this winter up the bay. From the sketch I have given, although I have not nearly exhausted the list of Newport birds, it is very evident that there is much here to occupy the student of ornithology, certainly one of the most interesting branches of natural history—the pursuit of which quickens our powers of observation, affords an object for pleasant and healthful out-door excursions, besides making us familiar with a most attractive part of the animal creation.

LIST OF BIRDS SHOT NEAR NEWPORT.

By COL. JOHN HARE POWEL.

At the meeting of the Newport Natural History Society, March 6, 1884, Colonel John Hare Powel read the following list of birds he has killed on the island of Newport :

Bald Eagle (one only in 1853 or 4), Osprey, Sparrow Hawk, Harrier (or Marsh) Hawk, Great Snow Owl, Horned Owl, Screech Owl, Grey Marsh Owl, White Swallow (an Albino), Snow Bird, Scarlet Tanager (Fire Bird), Shrike (Butcher Bird), Long-tailed Dove, Wild Pigeon, Gallinule, Purple Gallinule, Coot (Marsh Hen), Clapper Rail, Virginia Rail, Red-breasted Rail, Black-bellied Plover, Golden Plover, Ringed Plover, Wilson's (?) Plover, Piping Plover, Beetle-head Plover (Frost Bird), Killdeer, Turnstone, Red-breasted Sandpiper, Bartram's Sandpiper (Grass Plover),Red-backed Sandpiper, Buff-breasted Sandpiper (I think), Pectoral Sandpiper, Purple Sandpiper, Solitary Sandpiper, Spotted Sandpiper, Curlew Sandpiper, Sanderling, Great Curlew, (or Sickle bill), Jack Curlew, Esquimaux Curlew (Fute or Dough Bird), Willet, Great Yellow-leg, Little Yellow-leg, Common Marlin, Ring-tailed Marlin, English Snipe (Wilson's), Dowitcher (or German Snipe), Robin Snipe, Woodcock, Great Blue Heron, Night Heron, Bittern, Least Bittern, Canada Goose, Brent Goose, Snow (or Mexican) Goose, Mallard Duck, Black (Dusky) Duck, Widgeon (or Baldpate), Pintail Duck, Gray Duck, Summer (or Wood Duck), Gadwall, Green-wing Teal, Blue-wing Teal, Shoveller Duck, Canvass-back Duck, Red-head Duck, Broad-bill, Ruddy Duck, Velvet Duck, Surf Duck, Scoter Duck, Eider Duck, Great May White Wing (this is the bird that comes from the east and flies to the west in its spring migration in May, from the 10th to the 20th, and is seen at no other time of year), Golden Eye (or Whistler), Buffle-head Duck, Long-tailed Duck, Hooded Sheldrake, Cormorant, Gannet, Common Tern, Marsh Tern, Gray Gull, White Gull, Mackerel Gull, Fork-tailed Gull, Burgomaster Gull, Auk, Least Auk, Foolish Guillemot, Great Loon, Red-necked Loon, Tinker Loon, Pied-bill Grebe, Red-necked Grebe (young only), Phalarope, Mother Carey's Chicken, and, on the mainland of the State, Quail and Partridge (Ruffed Grouse). Total, 101.

ON SOME OF THE LOWER FORMS OF ANIMAL LIFE.

By RICHARD BLISS.*

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*Title of paper read before the Society on April 3d, 1884.

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PLATE I.

Topographical Map of the "Paradise" Rocks, near Newport.

PLATE II.

Sections across "Paradise" from near the Swamp Road, about E. by S. to Gardiner's Pond; Length, 1000 yards.

PLATE III.

Sections of Mica Schist Strata, of probable Carboniferous age, on Dutch Island in Narragansett Bay.

PLATE IV.

View of Mount Tacoma from the West.